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SOCIETAL LIFE CYCLE ASSESSMENT

Characterisation of social impacts in LCA. Part 2: implementation in six company case studies

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Abstract
Background, aim and scope A characterisation model based on multi-criteria indicators has been developed for each of four impact categories representing the labour rights according to the conventions of the International Labour Organisation (ILO) covering: forced labour, discrimination, restrictions of freedom of association and collective bargaining and child labour (Dreyer et al., *Int J Life Cycle Assess*, 2010a, in press). These impact categories are considered by the authors to be among the obligatory impact categories in a Social LCA. The characterisation models combine information about the way a company manages its behaviour towards some of its important stakeholders, its employees, with information about the geographical location and branch of industry of the company and the risk of violations of these workers' rights inherent in the setting of the company. The result is an indicator score which for each impact category represents the risk that violations occur in the company. In order to test the feasibility and relevance of the developed methodology, it is tested on real cases.
Materials and methods The developed characterisation models are applied to six cases representing individual manufacturing companies from three different continents. Five of the case companies are manufacturing companies while the sixth is a knowledge company. The application involves scoring the management efforts of the case company in a multi-criteria scorecard and translating the scores into an aggregated performance score, which represents the effort of the management in order to prevent violations of the workers' rights to occur in the company. The company performance score is multiplied by a contextual adjustment score which reflects the risk of violations taking place in the context (in terms of geographical location or industrial branch or sector) of the company. The resulting indicator score represents the risk that violations take place of the labour right represented by the impact category.
Results The social impact characterisation is performed for each of the six case studies using the methodology earlier developed. The procedure and outcome are documented through all the intermediary results shown for all four obligatory impact categories for each of the six case studies.
Discussion The results are judged against the risk which was observed during visits and interviews at each of the six case companies, and their realism and relevance are discussed. They are found to be satisfactory for all four impact categories for the manufacturing companies, but there are some problems for two of the impact categories in the case company which represents knowledge work, and it is discussed how these problems may be addressed through

Glossary Terms frequently applied in this article is explained in a glossary available in the back.

Preamble The present paper is the second in a series of two. The characterisation model based on multi-criteria indicators representing fundamental labour rights presented in the first paper is implemented in six company case studies and evaluated on this basis in the present paper. (Part 1: development of indicators for labour rights).

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change of the underlying scorecard or the way in which the scoring is translated into a company performance score.
Conclusions It is concluded that it is feasible to perform a characterisation of the impacts related to the four obligatory impact categories representing the labour rights according to the conventions of the ILO covering: forced labour, discrimination, restrictions of freedom of association and collective bargaining and child labour. When compared with the observed situation in the companies, the results are also found to be relevant and realistic.
Recommendations and perspectives The proposed characterisation method is rather time-consuming and cannot realistically be applied to all companies in the product system. It must therefore be combined with less time-requiring screening methods which can help identify the key companies in the life cycle for which a detailed analysis is required. The possibility to apply country- or industry sector-based information is discussed, and while it is found useful to identify low-risk companies and eliminate them from more detailed studies, the ability of the screening methods to discriminate between companies located in medium and high-risk contexts is questionable.

Keywords Corporate social responsibility (CSR) · Human rights · International Labour Organisation (ILO) · Labour rights · Life cycle management (LCM) · Multi-criteria indicators · Social audit · Social LCA · Social LCIA

Abbreviations

CRF	Company free rein
CRC	Contextual risk class
CAF	Contextual adjustment factor
CR	Company risk
CP	Company performance
CP_{max}	Maximum company performance
PRS	Product risk score
ISO	International Organization for Standardization
ILO	International Labour Organisation
NGO	Non-governmental organisation

1 Introduction

Following Dreyer et al. (2005, 2010a), a social life cycle assessment may be composed of individual assessments of the conduct of companies in the product chain towards their main stakeholders (company assessments). For assessing the observance of fundamental employee rights on a company level, multi-criteria indicators have been developed to evaluate the implementation of managerial measures which systematically address the issues raised by the core conventions of the International Labour Organisation (ILO). Each indicator addresses the company's guidelines and practices, its delegation of responsibility for compliance, its internal communication about management practices and policies and the monitoring of all of these. These multi-criteria indicators form the basis for calculating a performance score for four labour right issues, treated as separate impact categories in a subsequent characterisation. In the characterisation, the multi-criteria-based assessments of the company's management efforts are combined with assessments of the external risk environment (context) in which the company is operating. The results are company risk scores, which express the risk that labour rights violations take place in the company. The characterisation method is documented in Dreyer et al. (2010a).

This paper presents the application of the characterisation method in six company case studies. Four Social life cycle assessment (LCA) impact categories are covered, viz. forced labour, discrimination, restrictions of freedom of association, right to organise and collective bargaining[1] and child labour. These four impact categories are all obligatory impact categories from the framework developed in Dreyer et al. (2005)[2]. Chapter 2 of this paper briefly introduces the company case studies, and chapter 3 presents the calculation steps of the characterisation and the results obtained in the six case studies. The multi-criteria indicators, context classification and characterisation method are discussed and evaluated in chapter 4 based on the experience with application of the method; chapter 5 reflects on its general feasibility and applicability leading to conclusions and outlook in chapter 6.

2 Company case studies

Table 1 presents the companies behind the case studies. For each company, an assessment using the four labour rights indicators has been carried out. Companies A–E are all traditional manufacturing companies predominately employing blue-collar workers for handling automated production of a simple industrial product. Company F is an office company, which only employs white-collar

[1] In literature, the term freedom of association is often used as a collective term for all three elements of the ILO Conventions no.97 and no.98: freedom of association, right to organise and right to collective bargaining. For reasons of simplicity, we here chose to abbreviate, in accordance with this practice, the impact category Restrictions of freedom of association, right to organise and collective bargaining to restrictions of freedom of association and the corresponding indicator to freedom of association, even though these have a much broader scope than the abbreviated names suggest.

[2] The indicators developed for these four labour rights impact categories are presented in (Dreyer et al. 2010b, c), and the development of multi-criteria performance indicators and characterisation method for labour rights issues is presented in (Dreyer et al. 2010a).

Table 1 Companies assessed in the case studies

Company	Location	Employees	Type of company
A	Malaysia	148	Manufacture
B	Brazil	105	Manufacture
C	Croatia	180	Manufacture
D	Hungary	388	Manufacture
E	Israel	48	Manufacture
F	Denmark	40	Knowledge

workers for handling product sales, administrative tasks and research and development.

The data collection was carried out in the companies during one visit of 1 to 3 days depending on the presence and availability of the relevant persons needed for interviews, and generally, it included a factory tour. Key respondents were all chosen by the plant manager, but the person responsible for human resources was a mandatory participant. Evidence was presented voluntarily by the companies, and in general, interviews were easily conducted. During the interview other personal was sometimes brought in to answer specific questions on request. In general, the interviews were conducted in a very dynamic manner allowing for some participants to slip in and out while carrying out essential work functions in parallel. This fashion allowed the practitioner to repeat essential questions to verify information or ask silent participants in confidence. Some information was also retrieved during coffee and lunch breaks where otherwise silent participants tipped of the practitioner about inconsistencies and cover-ups. To avoid respondents preparing their answers for the interview, no specific information was given prior to the visit. The interviews were conducted in English, however, in several companies with the help of an interpreter since not all participants spoke English. At the end of each visit, all indicator scorings with explanatory notes were accepted (often after a few revisions) and signed by all participants to avoid any misunderstanding between the data collector and the respondents arisen during the data collection. After the actual data collection, the companies were monitored for a subsequent period of half a year to 2 years.

In addition to the conditions of work exposed during the scoring and later monitoring,[3] the presence of risk in company was also judged more in a more intuitive manner on the basis of the general impression of the facility; visual signs of violations; received awards connected to social or environmental performance; company certifications; transparency of management systems; reporting and other external communication; internal communication and openness in the company; appearance and attitude of employees and managers; employee satisfaction; participants' qualifications, seriousness and engagement; top management's commitment to social responsibility; company openness towards local community and grievances and disputes involving the company.

[3] More elaborate presentation is available in Appendix 2 in the Electronic Supplementary Material.

3 Characterisation of social impacts

The scoring of the company management efforts against the criteria of the four labour rights indicators forms the basis of the impact characterisation described below. The characterisation converts the indicator scorings into a risk score for each of the impact categories passing through three steps: (1) Calculation of company performance, (2) Calculation of company free rein, and (3) Calculation of company risk.[4] The characterisation method applied in the case studies is presented and discussed in detail in Dreyer et al. (2010a), but Section 3.1 gives a brief introduction to the calculation steps and exemplifies them for the forced labour impact category. The results of context risk assessments, which are used in the calculation of the company risk score, are presented in Section 3.2, and the final characterisation scores obtained in the six case studies results are presented in Section 3.3.

3.1 Steps of characterisation

The company performance score (*CP*) expresses a company's efforts and ability to manage a particular issue. It is calculated for each impact category by attributing values to the scoring of the company management efforts using the value set developed for the multi-criteria indicators on labour rights (Dreyer et al. 2010a, d). For each managerial measure of the multi-criteria indicator, the scored implementation degree for each of the three integration efforts is multiplied, and the company performance score is calculated as the sum of the resulting scores across all managerial measures. An example of value attribution and calculation of company performance score is presented in Appendix A for the indicator abolition of forced labour, and results for all six case studies for this indicator are presented in the first row of Table 2.

All indicators cover obligatory managerial measures as well as additional managerial measures. The latter are included in the indicator scoring if they are relevant for the

[4] In addition to these three steps, which concern the assessment of the individual companies in the product chain, there is a fourth step concerning the relation between the companies and the product and the conversion of company scores along the product chain into a social impact score for the product. This step is only relevant when a full LCA is performed and it is hence not implemented in the case studies here (see Characterisation of obligatory impacts in Dreyer et al. (2010a)).

Table 2 Calculation of company performance score (CP), company free rein (CFR) and company risk score (CR) in the characterisation of forced labour impact scores for all six case studies

Steps in characterisation (calculations)	Case study A Malaysia	Case study B Brazil	Case study C Croatia	Case study D Hungary	Case study E Israel	Case study F Denmark
I: Company performance score (*CP*)	164	146	160	208	139	161
Maximum company performance score (CP_{max})	304	272	256	288	272	272
II: Company free rein (*CFR*) $(CP_{max}-CP)/CP_{max}$	0.46	0.46	0.37	0.28	0.49	0.41
Contextual risk class (CRC)	2	1	4	4	3	5
Contextual adjustment factor (CAF)	0.9	1	0.5	0.5	0.7	0.4
III: Company risk score (CR) CFR×CAF	0.42	0.46	0.19	0.14	0.34	0.16

company being assessed (see indicator in Appendix A for illustration; Dreyer et al. 2010c). The number of measures which are applicable for each of the indicators may thus vary from case study to case study, and therefore, the company performance scores are not immediately comparable across the case studies. The company performance score must be seen relative to the highest achievable performance score (CP_{max}) in each case study to allow comparison across impact categories and company assessments. This is done in the company free rein (*CFR*) score, which is calculated by subtracting the actual company performance score (*CP*) from the optimal company performance score (CP_{max}) and subsequently indexing by dividing with the optimal performance (CP_{max}; third row of Table 2). In addition to facilitating comparison across impact categories and case studies, the indexation facilitates the later contextual adjustment. The company free rein expresses the degree to which circumstances allowing violations of labour rights to take place are present.

A company belongs to a specific geographical location and industrial branch or trade, which is characterised by a certain risk of labour rights violations occurring. This context must be taken into account when assessing the risk of violations actually occurring in the company. The company risk score expresses the risk of violations as judged from the assessment of the company's management performance with consideration of the context of the company (last row of Table 2). It is calculated by multiplying the free rein with a factor expressing the context risk (CAF; second last row from the bottom of Table 2). The assessment and classification of the context risk in the case studies are described in Section 3.2.

3.2 Assessment of context risk in case studies

Context risk assessment is performed as a desk study of prevalence of labour rights violations in the context of the case study company. Each context is classified according to the Context risk classification in Table 3 on the basis of frequency of occurrences of violations in the country and in the proximity (geographically as well as in terms of industrial branch or trade) of the company. The risk classes assigned to the contexts of the six case study companies are shown in Table 4. Each contextual risk class of the Context risk classification is accompanied by a CAF expressing context risk on a scale between 0.4 and 1 (Dreyer et al. 2010e). The contextual adjustment factor is applied in characterisation in order to arrive at a company risk score as illustrated in the last three rows of Table 2. The desk study and assessments underlying the results in Table 4 are documented in more detail in Appendix 1 in the Electronic Supplementary Material.

Table 4 shows that the contexts of companies A and B are the most problematic of all case studies in regards to risk of labour rights violations. For all four impact categories, the contexts of these companies are considered to pose high risk (i.e. CRC 1 and 2), which means that violations of labour rights are common or widespread. The management effort in these companies must hence be strong in order to ensure low risk of violations. In the opposite end of the scale is the context of company F, where the violations are much less likely to occur, and hence, less management effort is needed and expected due to the lower prevalence of violations in the context of the company.

3.3 Case study results

Table 5 shows the company free reins in the six case studies. The company free rein is based entirely on performance, whereas the characterised results, the company risks in Table 6, take the external risk environment of the companies into account via the contextual risk adjustment. Both the company free rein and company risk scores run in the interval [0;1]. A high free rein score indicates large possibility of workers' rights violations,

Table 3 Context risk classification and contextual adjustment factors to be applied in characterisation of labour rights indicators in Social LCA

Context risk classification				Attributed value
Contextual risk class (CRC)	Probability of occurrence in context	Violations in the country	Violations in proximity to company	Contextual adjustment factor (CAF)
1	Very likely	Common	Unknown	1.0
		Widespread	Occurrences in both industry and near location*	
		Widespread	Occurrences in either industry or near location*	
		Several	Occurrences in both industry and near location*	
2	Likely	Widespread	Unknown	0.9
		Several	Occurrences in either industry or near location*	
		Isolated	Occurrences in both industry and near location*	
3	Possible	Several	Unknown	0.7
		Isolated	Occurrences in either industry or near location*	
4	Unlikely	Isolated	Unknown	0.5
5	Very unlikely	Non-existent	–	0.4

* Near location is defined as the same region of the nation or the same state or city, where the company is situated (Dreyer et al. 2010e)

while a high company risk indicates a large probability that workers rights are being violated.

The value attribution to the multi-criteria indicator results has been developed so establishment of guidelines or practices in the company's management (integration effort I of the indicator)[5] and communication and delegation of responsibility of these (integration effort II) forms a strong basis for risk minimisation, but active control (integration effort III) is necessary to achieve medium and low company risk (see company risk classification in Table 7) in contexts associated with high risk, e.g. as for case studies A and B (Dreyer et al. 2010d). The contextual adjustment factors have also been set honouring this prerequisite and ensuring that the best achievable company risk placement in a low-risk context is medium with a maximum free rein (*CFR*=1; Dreyer et al. 2010e). More concretely phrased: if a company scores maximum in efforts I and II for all measures in a indicator (a broad effort equivalent to *CFR*=0.5), it will end in the high to medium risk category if the context is classified as CRC 1 or 2, in medium for CRC 3 and 4 and in low for CRC 5. In order for a company assigned CRC 1 or 2 to move into the medium company risk category, it must initiate active control of at least three measures in supplement to the broad management effort. Company B in the restrictions of freedom of association impact category serves as a good example of this. The context of company B is assigned CRC 2, and the company free rein is just below 0.5. The company performs very well in regards to practices (I) and communication and delegation of responsibility for these (II) by scoring maximum for all measures in the indicator. Company B, however, only carries out active control (III) for two measures, which results in a classification in the high to medium risk category, whereas active control of just one more measure would move the company into the medium risk category. Table 8 labels the company risk scores obtained in the six case studies (see Table 6) in risk categories on the basis of the company risk classification in Table 7. The case study results are discussed in the following chapter as part of the evaluation of the multi-criteria indicators and the characterisation method.

4 Evaluation of multi-criteria indicators, context risk classification and characterisation method

The multi-criteria indicators, context risk classification and the characterisation method which have been implemented in the case studies must be evaluated and judged on their feasibility and on their ability to produce reasonable results. Observations made in the case study companies during and after the data collection regarding both the feasibility of the scoring and the presence of risk of labour right violations are valuable inputs to the evaluation of the different elements of the Social LCA method. Furthermore, the desk study of labour rights violations in the case study contexts provides important feedback regarding the feasibility of context risk classification method.

In order for the multi-criteria indicators to contribute to correct prediction of risk by the characterisation model and

[5] See multi-criteria indicator model in Fig. 2 in Dreyer et al. (2010a).

Table 4 Contextual risk classes (CRC) determined for the six case study contexts for each of the four impact categories

Contextual risk class (CRC)	Company A Malaysia	Company B Brazil	Company C Croatia	Company D Hungary	Company E Israel	Company F Denmark
Child labour	2	1	3	4	3	5
Forced labour	2	1	4	4	3	5
Discrimination	1	1	2	2	1	3
Restrictions of freedom of association (abbr.)	1	2	3	2	3	4

The context risk assessments are summarised in Appendix 1 in the Electronic Supplementary Material

ultimately lead to the right management decisions regarding improvements both for the individual company of the life cycle and for the whole life cycle of a product, the assessment parameters of the multi-criteria indicators, subject-dependent as well as subject-independent, must accurately reflect a company's will and ability to manage a labour right issue with the purpose of minimising risk of violations. It follows that, in principle, the managerial measures of the multi-criteria indicator must cover all aspects of a labour right and all possible situations where violations may occur while at the same time be relevant and meaningful even though they in some companies may be of less significance for obtaining a low-risk level due to a influence of a low risk of context. The integration efforts of the multi-criteria indicators must reflect effectiveness in integration of these managerial measures with the purpose of preventing violations from taking place (Section 4.2).

The contextual adjustment step of the characterisation establishes the significance of company management performance and contextual risk of violations in the company by reflecting the need for management effort as consequence of the risk level of branch of industry, near location and country. Whether this relationship is balanced in the characterisation will reflect in relevance of the required management efforts for companies to improve their company risk scores when considering observed risk in the companies and surroundings. However, since contextual risk adjustment emphasises the weighting of integration efforts made in the multi-criteria indicator model with increasing context risk, the relevance of required improvements to lower risk also provides feedback to choices made in the value attribution to scoring (Section 4.3).

Accuracy of assessment will prevail in whether relative (Section 4.3) and absolute (Section 4.4) placement of companies on the company risk scale is in accordance with the observed risk in the companies and their contexts. The accuracy may be adjusted via (1) the individual multi-criteria indicator's way of measuring (representation of aspects and formulation of measures) as well as in the direct and indirect weighting (attribution of value) of integration efforts, aspects and risk situations in the indicators and (2) the magnitudes of contextual adjustment factors (Section 4.4).

4.1 Feasibility of the context risk classification method

From Table 4, it is visible that all classes of the context risk classification (see Table 3) are relevant in this study. For the impact categories child labour and forced labour, the case study companies are distributed between all possible classes, whereas the risk classes are in the high end for the impact categories discrimination and restrictions of freedom of association. This is likely to be a characteristic picture. There are countries without any reported occurrences of forced labour or child labour, whereas discrimination is hard to avoid completely, and even in countries where the trade union movement is strong, violations sometimes occur. The locations of the case study companies are geographically widespread, and their contexts include developed, emerging and developing economies including transitional economies, which beforehand suggest

Table 5 Company free rein (CFR) calculated for each of the six case companies on the basis of their indicator scorings*

Company Free Rein (CFR)	Company A Malaysia	Company B Brazil	Company C Croatia	Company D Hungary	Company E Israel	Company F Denmark
Child labour	0.67	0.54	0.74	0.54	0.67	0.55
Forced labour	0.46	0.46	0.37	0.28	0.49	0.41
Discrimination	0.56	0.14	0.63	0.38	0.50	0.68
Restrictions of freedom of association (abbr.)	0.84	0.45	0.46	0.88	0.57	0.84

* Refer to Table 2 for calculation method

Table 6 Company risk (CR) calculated for each of the six case companies on the basis of their free rein (CFR; Table 5) and contextual adjustment factor (CAF; Table 4)*

Company Risk (CR)	Company A Malaysia	Company B Brazil	Company C Croatia	Company D Hungary	Company E Israel	Company F Denmark
Child labour	0.60	0.54	0.52	0.27	0.47	0.22
Forced labour	0.42	0.46	0.19	0.14	0.34	0.16
Discrimination	0.56	0.14	0.57	0.34	0.50	0.48
Restrictions of freedom of association (abbr.)	0.84	0.41	0.32	0.79	0.40	0.42

* Refer to Table 2 for calculation method

significant differences in risks of labour rights violations. The classification seems sufficiently differentiated to accommodate the risks encountered in the case study contexts, and given the diversity of these contexts, this gives us reason to believe that it will suffice in other cases as well.

In the 24 context assessments, which were carried out as part of the case studies, some cases of ambivalence in the classification arose, particularly regarding class 3 several violations and the border to class 2 widespread violations for those impact categories where estimates of the extent of violations in the context were available (typically forced labour and child labour). In general, class 3 ended up being a rather broad risk class. The class encompasses both contexts where there are few violations, but more than what can be considered isolated and random violations, and contexts where violations are many, but not widespread. For example, the assessment of prevalence of child labour for the contexts of company C and E places them both in class 3 even though risk is considered significantly higher in the context of E. However, it was also often found difficult to distinguish these two violations patterns from each other on the basis of the sources available and hence not justified to make further division of classes.

Overall, the desk study was able to provide the information necessary to determine context risk in accordance with the classification. Considering the quality of the source material for these case studies, it would not have facilitated the risk assessment had the classification in Table 3 been more detailed (i.e. had it contained more risk classes).

Neither of the specific industries of the case studies was mentioned in the source material considered by the desk study as common violators. More generally, small-scale industry, small manufacturing companies and industrial sector were mentioned as violators of specific rights, but these were not specified further. None of the relevant near locations was singled out as particularly problematic in regards to violations, so the determination of contextual risk class was entirely based on assessment of country prevalence of violations for all contexts. Specific industries and near locations were however considered by information sources applied in the desk study on several occasions. These were not consistently considered, but mainly for countries where violations were widespread or common. This indicates that it is relevant to include proximity to company as part of the context risk assessment despite the fact that it was not considered in connection with the six case studies presented here.

Table 7 The Company risk classification defines five classes of company risk (CR; Dreyer et al. 2010d)

Company risk classification	
Company risk score	Definition of company risk
$0.9<CR\leq1.0$	Very high risk
$0.6<CR\leq0.9$	High risk
$0.4<CR\leq0.6$	High to medium risk
$0.2<CR\leq0.4$	Medium risk
$0.0\leq CR\leq0.2$	Low risk

4.2 Scoring company management effort with multi-criteria indicators

4.2.1 Scoring concept of multi-criteria indicators

The scoring concept of the indicators and the indicators themselves were easy to understand for the people involved in the data collection in the case studies, whereas the scoring process showed to be less straightforward and required a skilled practitioner. It was often experienced in the case studies that respondents tended to make the company performance appear better than it actually was, for several reasons, despite the fact that the practitioner had the possibility to validate most of the information presented given his presence on site. Sometimes, it was clear that respondents answered in accordance with their best convictions and when investigated further, their answers showed to be wrong because their perception of things did not agree with how they actually were. This revealed a need for the practitioner always to go into depth, rather than

Table 8 Categorisation of company risks in the six companies (Table 6) according to the company risk classification (Table 7)

Company risk	Company A Malaysia	Company B Brazil	Company C Croatia	Company D Hungary	Company E Israel	Company F Denmark
Child labour	**High to medium**	**High to medium**	**High to medium**	**Medium**	**High to medium**	**Medium**
Forced labour	**High to medium**	**High to medium**	**Low**	**Low**	**Medium**	**Low**
Discrimination	**High to medium**	**Low**	**High to medium**	**Medium**	**High to medium**	**High to medium**
Restrictions of freedom of association *(abbr.)*	**High**	**High to medium**	**Medium**	**High**	**Medium**	**High to medium**

relying on the openness of the process, in order to arrive at a proper assessment of the management performance and the internal risk environment. Hence, these experiences also dismissed the possibility of reliable self-assessment as an alternative to on site data collection.

The case studies also showed that it is important to approach from more than one angle when posing questions during scoring, because the respondents of course only answers the question they think is asked, meaning that if a question is posed in a slightly different way, the response may be entirely different. Even though efforts have been put into formulating precise and unambiguous criteria these were not perceived the same way across countries and cultures. The role of the practitioner as a communicator of the intentions of the criteria therefore showed to be important for the quality and comparability of the result achieved from the scoring.

4.2.2 Integration of efforts I, II and III of the multi-criteria indicators

The indicators' division of management into three main efforts makes it possible to measure the degree of integration into daily work, which results in a more multifaceted reflection of the conditions in the company. As could be expected, implementation of practices (integration effort I) and delegation and communication of responsibility for these (integration effort II) often coincided in scoring, but not always, which advocated for the necessity of having both as separate assessment parameters in the indicators. The combination of integration effort I and II in the scoring was very productive in uncovering inefficiency in existing management systems or specific practices and guidelines during the data collection. It was experienced that some companies had very comprehensive and impressive written management systems with procedures apparently dealing with a variety of processes in the company, but the systems lacked in the actual integration into daily work. Sometimes, the reason was that responsibility for compliance was not directly delegated to the relevant persons or that they lacked procedures for informing new employees (II), while at other times the existing procedures were too comprehensive or impracticable to actually being followed (I).

Active control (integration effort III) was at times difficult to score because the practitioner had to assess what actions the active control had to involve in order to be effective in the concrete organisation and management setup. In the case companies, there was a tendency toward managing many activities (measures) well rather than managing a few activities excellently, i.e. a broad management effort rather than a focused effort. The performance scores in the case studies are thus predominately comprised by integration efforts I and II. In most of the case studies, it was experienced that active control of the measures in the indicators did not move beyond a basic level, which often could be ascribed to presence in a low-risk context. This scoring is what might be expected from companies for whom it is not required to document observance in order to gain some sort of licence to operate or a competitive advantage. Beyond the basic level, which may vary with external circumstances, control or monitoring is more likely to be carried out as part of a targeted management effort focused on the particular issue of the indicator, as for example in company B where they carry out internal audits on the topic of non-discrimination or in conjunction with a certification scheme, which addresses some or all of the measures of an indicator, e.g. ISO14000 (ISO, 2004), OHSAS 18000 (DNV, 1999), SA8000 (SAI, 2001).[6]

Despite the companies' mediocre performance in regards to active control of preventive measures, observations on site confirmed the relevance of active control both in high and medium risk contexts (CRC 1, 2, 3) in order to ensure low risk of violations (see risk classes for the case

[6] Companies A–E are ISO 14001-certified and companies A, D and E are additionally OHSAS 18001-certified. This influenced the scoring in regards to non-discrimination to a small degree. For more details, refer to the more elaborate presentation of case study results in Appendix 2 in the Electronic Supplementary Material.

companies in Table 3). Control is an important part of lowering the risk of violations. Besides having the preventive effect on premeditated as well as unintended violations, it also reveals where procedures, guidelines or practices are insufficient, which may form basis for a continuous improvement process lowering risk if an efficient feedback process is set up. For example, in both companies B (CRC 2) and C (CRC 3), there were indications that the constructiveness of both collective bargaining and consultation (freedom of association indicator) was affected by the lack of competences of the union representatives, a problem which is not uncommon in the mentioned countries. If the companies had been carrying out active control, this problem would most likely have been identified, and the company would have had to address it. In a high-risk context such as that of company A (CRC 1), it was evident that active control would provide reassurance that existing practices indeed were preventive of discrimination (non-discrimination indicator), which rightfully was reflected by the relatively high company risk score and resulting placement in high to medium company risk category for this impact category. Company B showed that active control is feasible in regards to the measures ensuring non-discrimination, which resulted in an impressively low company free rein and a placement in low company risk category despite operating in a high-risk context (CRC 1).

4.2.3 Coverage of multi-criteria indicators

The predominately broad scoring of the companies A–E indicates that the indicators' coverage of risk aspects through preventive measures is good in terms of relevance. In the scoring, the measures neither were excessive effort nor irrelevant because they were overt courses of action. This was further supported by the fact that inadequate performance in the companies was often caused by lack of different measures, rather than the same.[7] Significant risk aspects or risk situations not included or covered by the preventive measures of the indicators were not encountered in the scoring of the companies A–E, but this should be seen in light of the generally responsible conduct of these companies. More case studies including companies associated with higher risk might uncover additional risk aspects.

In the scoring of company F, it was experienced that the minimum age for employment, abolition of forced labour and freedom of association indicators did not work optimally. The three indicators were found not to be adequate in capturing the work situations of salaried professionals on two accounts; firstly, some measures do not apply to the work situation unless interpreted very liberally, and secondly, it is questionable to what degree lack of some measures may serve as indication of presence of circumstances allowing labour rights violations to take place. As a result, actions for improvement on the basis of the scorings for the three indicators did not necessarily lead to lower risk of labour rights violations taking place in the company F (for more details refer to Appendix 2 of the Electronic Supplementary Material). Regarding specific risk aspects or risk situations lacking coverage, none was identified during the scoring of company F or later monitoring.

Since the indicators worked fine in the other cases studies, the problem suggests that it is not the same circumstances that indicate risk of violations in the two different types of companies represented by F (knowledge company) and A–E (manufacturing companies) and therefore not the same measures that work to prevent violations of some labour rights. The cause may be found in the differences in the typical employment conditions and organisation of work in a knowledge company, such as F, compared with a traditional manufacturing company, such as companies A–E. In the scoring of minimum age for employment and abolition of forced labour for case study F, we also find that the possible emergence of risk situations is different for F and A–E, due to the type of work carried out in F. Intellectual work which demands a certain educational level largely rules out the possibility of hiring children. Some intellectual workers may be subjected to milder forms of forced labour, but the degree to which work may be exacted under the menace of penalty or undertaken involuntarily depends very much on the exact nature of the work. The assessment of risk in the company is nevertheless still relevant; the multi-criteria indicators must still be able to give correct indication. In these cases, we must consider that the preventive measures in the multi-criteria indicators should be different in choice and formulation to capture actual risk situations or be able to display the lack of such in this type of company. This is mainly a question of how the ILO conventions are interpreted for the formulation of measures.

The problem with the three labour rights indicators' feasibility in knowledge companies or similar companies cannot be pinned down on the basis of the empirical observations from just one such company, particularly because the low-risk context of company F may distort the observations by emphasising the feeling that the assessments are not meaningful. By comparing results of scoring and observations in the same type of company in different countries, we may be able to distinguish the influence of the low-risk context and determine to what degree the problems with the indicators experienced here are related to the type of company. Even though we do not suspect this to be the cause, more cases will also confirm

[7] For exceptions to this general picture, refer to the more elaborate presentation of case study results in Appendix 2 in the Electronic Supplementary Material.

whether some of the problems encountered in case study F are related to context-specific characteristics, which are not general for a low-risk context, e.g. specific national legislation or if the problem is related to specific company management characteristics, which are not typical for the type of company. Moreover, manufacturing companies are alike in organisation, while intellectual service companies are more likely to differ depending on the specific work carried out and the country of location, which means we may discover that there are additional or other measures that are not working for other knowledge companies.

4.3 Dynamics of characterisation

Overall, the combination of the three management efforts of the multi-criteria indicators and the contextual risk adjustment worked as intended in most of the case studies. The contextual risk adjustment curbed the multiplicative amplification effect of the multi-criteria indicators in low-risk contexts, so active control never became decisive for placement in lower company risk categories, whereas in high-risk contexts it sustained the need for active control, which was in accordance with observed management needs.

Figure 1 shows how the contextual risk adjustment influenced the calculated company free rein (see Table 5) in the calculation of company risk scores (see Table 6) for the child labour impact category. More specifically, Fig. 1 shows that the contextual risk adjustment of free rein has the largest effect on companies D and F indicating significantly lower topicality of child labour in these contexts compared with the contexts of the other companies. Company F is the only company placed in a context where child labour is very unlikely to occur (CRC 5). The free rein of company B is the lowest among the case companies due to the management efforts of this company, but is also the only company located in a context where child labour is considered common (CRC 1). The results for the remaining impact categories are presented in detail in Appendix 2 in the Electronic Supplementary Material.

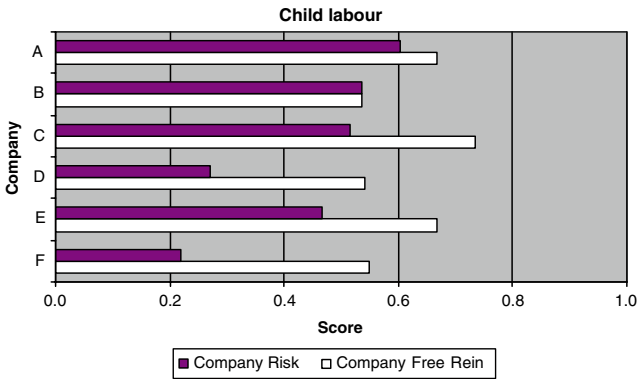

Fig. 1 Company risk (CR) and company free rein (CFR) scores for the six case companies for the child labour impact category (based on Table 5 and 6)

The effect of the contextual risk adjustment is in most of the cases moderate, so the challenges involved in placing companies in the right contextual risk class (see Section 3.2) must be seen in light of its mild influence on the resulting company risk.[8] In almost all cases, the change of contextual risk class one class up or down would not affect the final risk category placement of the company. For example, whether the context of company B is assigned CRC 1 or 2 in regards to child labour does not change the fact that the company risk is assessed to be high to medium (see company risk classification in Table 7).

4.3.1 Companies A–E, the manufacturing companies

The degree of management effort implicitly required of the companies A–E, by the indicators, according to the companies' location in the concerned risk contexts, was generally considered reasonable. The areas of improvement which could be identified on the basis of the indicator assessments in order to lower risk of labour rights violations to a minimum were largely relevant and acceptable for companies A–E when considering the context risk. In the situations where increased active control was the main improvement potential, it could sometimes be debated whether the observed internal risk and the assessed context risk actually justified the strengthened active control which was needed in order for the company to be classified in a slightly lower company risk category.

The relative placement of the companies A–E according to magnitude of the resulting company risk scores was generally concurrent with expectations based on context risk and observations on site during the data collection and the following monitoring. Two noteworthy exceptions were, company C, which has a surprisingly high score (0.515, high to medium risk) for child labour (see Fig. 1), and company D, which has a very low-risk score (0.342, medium risk) for non-discrimination (see Table 6).

For company C, which operates in a context not commonly associated with child labour, the relatively high-risk score arises due to a combination of mediocre management of apprentices and of employee grievances resulting in a high free rein and a modest contextual risk adjustment, which is justified by the context risk assessment. The case is discussed more in detail in Appendix 2 in the Electronic Supplementary Material.

In company D, a system ensuring equal remuneration has not been established and this, combined with the lack of

[8] On the influence of the contextual risk assessment see reflections in contextual risk classification of labour rights violations in Dreyer et al. (2010e).

collective bargaining in the company, gives grounds for concern because neither employee appraisal nor qualification levels or other similar objective criteria are formally applied in the wage setting, which gives room for discrimination. These circumstances ought to have affected the company risk score more significantly, but company D has a reasonably focused management effort in regards to non-discrimination, and the company carries out quite a lot of active control of the implemented practices, which results in a quite high performance score despite the lack of management of equal remuneration. This suggests that the multiplicative effect of the indicator model may be too strong in this case, putting too much emphasis on active control rather than coverage of risk aspects i.e. that the indicator model does not balance broad and focused management effort optimal in performance score in this case.

4.3.2 Company F, the knowledge company

For company F, the risk scores obtained in the characterisation for child labour, forced labour and non-discrimination are reasonable in comparison to the other case companies considering the observed risk of impacts. For restrictions of freedom of association, the company risk score is considered relatively high. Further examination of the characterisation, however reveals that the seemingly reasonable results are largely coincidental. Had the same company been located in a higher-risk context, it is likely that the results for child labour, forced labour and restrictions of freedom of association would have seemed much less reasonable because the contextual risk adjustment would have had less impact on the company free rein resulting in higher company risk scores. The experience with case study F points towards that child labour and forced labour violations are less likely to occur in knowledge companies compared with typical manufacturing companies, a notion which is supported by observations of labour rights violations patterns and type of industry (see Assessment of proximity to company in Dreyer et al. (2010e). Hence, we are in a situation where the branch of industry can be unaffected by the general prevalence level of the country. This poses a challenge for the use of the contextual adjustment carried out in the characterisation. When country prevalence is used as entry to the context risk classification, it builds on the assumption that increasing prevalence of labour right violations in the country increases the risk that violations take place in a company situated in this country. It implies that a strong prevalence on a country level typically will be reflected in the industry and the near location, which in the situation of company F is unlikely because of the type of work carried out. In case study F, there is a coincidence between what we may term "low-risk work" and low country prevalence of violations; so, in this situation, the contextual adjustment coincidentally serves its purpose by lowering expectations to management effort through adjustment of free rein. Everything points towards that characterisation must be adjusted accordingly in order to work for knowledge companies.

4.4 Company risk categorisation

The company risk categorisations presented in Table 8 show that the majority of companies end in the high-risk categories, half of them end in the high to medium company risk class. Even though many of the case companies should improve their management in order to entirely eliminate risk of violations, there is no reason to believe that there are deliberate violations in any of them on the basis of observations made on site in the companies during the data collection and the following monitoring. Therefore, it is a little surprising that the company risk scores generally place so high in the company risk classification. The way performance is assessed by the individual indicators may account for a general high-risk scoring for the individual impact categories, and the effect of the valuation model and contextual risk factors applied in the characterisation may account for a general high-risk scoring for all impact categories. This is discussed in the following sections.

4.4.1 Mode of risk indication by selected labour rights indicators

Eight out of the 12 high to medium risk classifications are found in the child labour and discrimination impact categories and the two high-risk classifications are found in the restrictions of freedom of association impact category, suggesting a closer look at the performance indicators representing these impact categories.

Minimum age for employment indicator observations from the case studies show that high-risk scores (and high free rein scores) in the child labour impact category are not necessarily synonymous with exploitation of children below general minimum age.[9] It is possible to get a high-risk score based on poor management of working conditions for apprentices (which is the case in the scoring of companies C and D) and young workers (which is the case for companies A and E). A general problem experienced with the scoring of the minimum age for employment indicator is that the need for managerial measures does not take into account the extent to which a risk aspect is present, only whether it is present or not. That is, if the company has apprentices or young workers, it must have

[9] The indicator distinguishes between three types of working children: (1) children below general minimum age hired to carry out light work (2) children hired as apprentices, and (3) children between general minimum age and 18 years of age (young workers) hired to carry out non-hazardous work.

practices addressing the working conditions of these to avoid that they carry out work inappropriate to their age, which would classify as child labour, regardless the extent to which apprentices or young workers are present. This is in accordance with the minimum age convention (ILO, 1973). In company A, young workers only work in summer holidays; in companies C and D, apprentices are usually children of employees and very sporadically employed; in company E young workers are most often children of employees. This means that the risk category placement is unrealistically high for the companies C, D, E (and to some degree A) considering the extent to which violations may take place in these companies as a result of the observed lack of management of the risk aspects. On the other hand, there is no doubt that, in general, the measures of the indicator are necessary to manage young workers and apprentices to ensure acceptable working conditions and avoid violations. It is thus acceptable that the company assessment indicates that if a company has working children, they must manage them. However, when many company assessments are combined in an LCA and hot spots are identified, it is important that it is possible to distinguish those companies where these risks are substantial from those where they are more hypothetic or only present to a limited degree. For the child labour impact category, a possible solution to ensure accurate indication on both company and life cycle level could be to increase the significance of the context risk via the contextual adjustment factors for this impact category. The likeliness that child labourers will be present in the company will thus to a higher degree be determined by context risk. We cannot be sure that this solution will provide a better indication, and it removes the incitement (score wise) for a company to appropriately manage working children if they only have a few or if they are located in a low-risk context (CRC 4 or 5), which is problematic in regards to the observance of the labour right. In this light, it is a question whether it is not better to accept the precautionary approach of the present indicator.

Non-discrimination indicator There were no particular problems encountered in the case studies that suggested that the non-discrimination indicator performance measurement was too low. As earlier mentioned, the companies generally had problems with the formalisation of hiring, which is not uncommon for this type of companies, but nonetheless relevant for ensuring equal access to employment. In combination with the possibility of discrimination in the contexts, high to medium risk of violations seems a reasonable assessment of risk for the companies A, C, E and F.

Freedom of association indicator Companies A and D are the only two companies among the case companies where no trade union is present. The companies also show the largest free reins for this impact category and in combination with the prevalence of violations of freedom of association, right to organise and collective bargaining in the respective countries, the companies end in the high company risk category. The indicator is constructed in such a way that, whether or not the company deliberately keeps the trade union out, the absence of trade union representatives on site will impact negatively on the performance score. If the reason for the absence in the specific situation can be explained by circumstances relating directly to the context, e.g. when freedom of association is limited by legislation, the company may take some additional measures (according to the indicator), which will enable higher performance score, but if the cause is of cultural or social nature, the company cannot take additional measures (facilitate parallel means to a union) in order to improve the performance because this could also be a means to obstruct employees freedom of association. In this way, a problem relating to the context can reflect in the company risk score both through the contextual risk adjustment and the performance scoring. It is judged on the basis of the context risk assessments and the interviews carried out during the data collections that it is not legal restrictions that hinder trade union representation in company A and D, and this is contributory to the high free rein scores and hence high-risk scores. It is important to note that there were indications during the interviews in the companies that suggested an attitude which was not entirely open towards unionisation, which could not be measured by the indicator, but which is concurrent with a significant presence of risk. It is debateable whether such indications actually justify a "high" company risk categorisation or whether "high to medium" risk would have sufficed. Considering that it can be difficult to uncover the true cause to absent trade union, it is however deemed acceptable that the indicator in this situation is slightly precautionary.

4.4.2 Value attribution and contextual adjustment factors

If the companies in the low-risk contexts have a tendency to high measured company risks compared with observed risks, it suggests that the contextual adjustment is not strong enough (assuming that the indicators are accurate in their prediction of risk), i.e. the contextual adjustment factors are too high. If the problems are more pronounced for companies operating in high-risk contexts (CRC 1, 2 and possibly 3), it is more likely due to the multiplicative effect of the valuation model because of the broad management effort of the case companies, i.e. that the weight on active control is too high. Value attribution is determined in such a way that active control is necessary to achieve "medium"

and "low" risk categorisation. There seems to be a small tendency to the latter being the situation. For the companies assigned CRC 3, 4 and 5, the placements which seem high can be explained by the general problems observed with company F (for the freedom of association indicator) and with company C and E (for the minimum age for employment indicator) described above. For the companies assigned CRC 1 and 2, only companies B and D in regards to non-discrimination deviate from the general picture that company risk scores generally seem a bit too high. For company B, low-risk score can be explained by an exceptional management effort, and for company D, the reason can largely be ascribed to the focused management effort, which supports that the multiplicative effect might be too strong. It is possible to choose other value-attribution models, which reduce the multiplicative effect in the calculation of performance score and thus lessen the weight of active control in the assessment of performance (see argumentation for choice of model and alternative models in Dreyer et al. (2010d).

The generally high-risk scores and in some cases too high company risk placements observed in the case studies can be attributed directly to the construction of some of the multi-criteria indicators and to some degree to the calculation of the performance score. Too much emphasis on active control was not a distinct problem in the case studies, however, there were some indications that the value attribution is based on a too conservative interpretation of company risk and may require an adjustment. On the basis of more case studies, we will be able to conclude whether it is necessary to adjust the value set or company risk classification, which it is based on, so the characterisation model becomes less conservative in its judgment of risk.

5 Feasibility and applicability of social LCA method

5.1 Applicability of labour rights multi-criteria indicators in different industries

The difficulties experienced with company F as opposed to companies A–E in the case studies teach us that, even though many of the activities concerning employees are the same in the two type of companies (e.g. hiring, firing), the work itself and the organisation of the work are significant for the presence of risk of violations and hence, for how this risk should be determined for some of the labour rights.

Indicators based on a managerial approach such as the labour rights indicators should optimally be formulated according to the type and characteristics of the company in order to capture actions which may result in impacts (actual risk situations) and avoid false indications where the impacts are limited due to the type of work e.g. child labour in knowledge companies. An industry-specific formulation of the indicators seems like the straightforward answer to this problem, but this solution constitutes an immense work task and introduces the risk of biases in the assessment of different types of industries. A grouping of industries on the basis of shared main characteristics influencing the formulation of indicators, e.g. company size, organisation of work, type of workers employed (skill and wage level), regional location of company (rural/urban), may be an alternative to reduce this work task.

The labour rights indicators presented here are best suited for assessment of larger traditional industries primarily employing blue-collar workers. This is the most vulnerable type of workers in terms of labour rights violations being unskilled and typically low-paid and therefore also a main stakeholder of the presented method.

In this paper, we have not discussed how the company risk scores are related to the product in the social LCA[10], but if the product relation of the risk scores of the companies in the product chain is based on the relative number of working hours which each company spends on the product, the industries which are labour intensive in the life cycle will dominate the results of the LCA.

5.2 Scoping using context assessment results

The work and time consumption entailed by the multi-criteria model calls for ways of focusing the analysis work in a Social LCA in order to concentrate on the companies where the largest social impacts are most likely to be found. The context risk assessment method developed for the characterisation model can be used for scoping in Social LCA. The companies in the life cycle can be divided into groups according to their context risk. On one hand, there are the high to medium risk contexts in CRC 1, 2, 3 and on the other the low to medium risk contexts in CRC 4 and 5. Based on experience from the case studies, we are inclined to expect that violations will be limited or of small consequence in the companies belonging to the latter group. If companies belonging to CRC 4 or 5 are given low priority in further investigations, it is considered unlikely that any problematic companies have been excluded. However, it is not possible on the basis of context risk assessment alone to determine how investigations of the remaining should be prioritised according to risk. In the group of companies operating in medium to high-risk contexts, the behaviour of the companies when managing the conditions of their employees strongly influences which companies actually have the highest risk

[10] About product relation, see Characterisation for obligatory impact categories in Dreyer et al. (2010a), Relating company impacts to the product and the functional unit in Dreyer et al. (2005) and Dreyer (2009).

of violations. This calls for a more site-specific assessment among these companies. Company B's management of non-discrimination, which was discussed in chapter 4, is a good example of a company disassociating from its high-risk context with an extraordinary management effort.

When a company works with social responsibility and wishes to improve conditions along its product chain, it may use its leverage to influence life cycle actors to consciously take responsibility for their actions in order to reduce negative impacts and improve positive. This will often entail requests that a company in the product chain distinguishes itself from other competing companies in the same context. Then, it makes little sense to apply a method which assesses social impacts based on the context of the company without consideration for its actual performance. In such situations, context risk assessment can thus not replace site-specific assessment in Social LCA. On the other hand, the method developed in Dreyer et al. (2010a) and applied in this paper simply cannot be applied without site-specific data on company performance. If access to site-specific data is limited, other simplified site-specific models may be considered; however, the limitations of such models must be duly considered before applied.

5.3 General feasibility considerations

The time consumption for carrying out company assessment with the multi-criteria indicators was considerable in the case studies for both data collector and data provider. The level of detail and required level of validation of the multi-criteria indicators makes it difficult to reduce this time consumption. Considering the resources required for conducting Social LCA applying the multi-criteria indicators and characterisation model presented here, it is considered to be less suitable as merely a measurement tool, e.g. for documentation of impacts in the life cycle of a product. The organisation commissioning the LCA must have a broader objective such as intentions of carrying out life cycle management (if product chain owner), and the data providers must have a stake in participation as well. Incentive of data providers may rely on leverage of inquirer and prospects of more business, partnership or similar.

6 Conclusions

The data collection in the case companies A–E shows that the ideal management approach, against which they are assessed via the managerial measures of the labour rights indicators, is suitable for the companies and in accordance with the context risk. Both in the high- and low-risk contexts, we see that required measures are relevant and that the three integration efforts are reasonable, even though we may discuss the emphasis on active control. In general, there was a good correlation between observed risk and assessed risk; however, some minor adjustments to the indicators are necessary, and the characterisation model may require some adjustment. Given the relatively small number of case studies upon which these conclusions are based, it is crucial that these adjustments to the labour rights indicators and characterisation model are based on more extensive empirical data.

The results of case study F indicates that, in their present formulation, abolition of forced labour, minimum age for employment and freedom of association indicators will primarily be applicable to traditional industries and industries employing blue-collar workers and to a lesser degree for companies employing intellectual workers or similar white-collar employees. The cause is to be found in the differences in the typical employment conditions and type and organisation of work carried out in a traditional manufacturing company compared with a knowledge company, where the measures of the indicators primarily are levelled at the former. The determination and formulation of managerial measures in the indicators should therefore be done in more deliberate accordance with the characteristics of type of company in which the indicators are intended to be used, in order to capture the actual risk situations and avoid false indications where the violations are limited due to the type of work, e.g. child labour in knowledge companies. On this basis, it is recommended to consider development of indicators for groups of industries.

The conducted case studies confirm the general applicability and feasibility of the inventory and characterisation steps of the method developed in Dreyer et al. (2010a). On this basis, it is also considered likely that other impacts may be included in Social LCA using this method as long as these can meaningfully be addressed within the managerial perspective underlying the multi-criteria indicators. It can be concluded that the method presents a good alternative to the more traditional direct indicators applied in Social LCA.

Social LCA Glossary for Part 1 and Part 2

Company: in the characterisation method "company" refers to the specific entity in the product life cycle contributing to the making of the product through raw materials extraction, manufacture of product components and semi-products etc., or actual handling of the finished product. That is, the term covers a single production site and not the entire corporation.

Company assessment: the individual assessment of the conduct of a company in the product life cycle towards their main stakeholders. Social LCA is comprised by numerous company assessments. A company assessment consists of

assessment with a number of performance indicators—one for each impact category included in the Social LCA.

Multi-criteria indicator: an indicator comprised of multiple assessment parameters used to collect social life cycle inventory data for an impact category. The multi-criteria indicator consists of a number of impact category dependent assessment parameters and a set of three impact category-independent assessment parameters. The first comprises managerial measures necessary to systematically manage company activities while implementation hereof is assessed using the latter measures efforts in integration into daily work.

Managerial measures: means to systematically manage an organisation's activities (business processes or work routines). Managerial measures are taken to avoid negative impacts on the area of protection. Managerial measures constitute the subject dependent assessment parameters of the multi-criteria indicator model.

Integration efforts: efforts made to integrate managerial measures effectively into daily practice with the purpose of preventing that impacts take place. Integration efforts constitute the subject-independent assessment parameters of the multi-criteria indicator model and comprise: (I) guidelines and practices (II) delegation of responsibility and communication about guidelines and practices and (III) active control.

Social aspect: a characteristic of a social issue of concern to be addressed through certain managerial measures by a company to avoid negative impacts on area of protection.

Company performance: a quantitative representation of a company's efforts and ability to manage a particular issue.

Company free rein: the degree to which circumstances are present in a company that allows negative impacts to take place make up the free rein of that company.

Context: the external environment, which the company forms part of and by which the company conduct may be influenced, for example through legal, social, cultural, economic and political practices.

Reference context: represents the external conditions of the company for which the managerial measures of the multi-criteria indicators are defined as a desirable management effort to ensure a minimum risk of negative impacts. The reference context is characterised by very high risk in order to achieve best possible coverage of indicators.

Context assessment: assessment of probability of impacts in the external environment of a company. Context assessment is carried out for all impact categories for the contexts of the companies comprised by the Social LCA as part of the inventory step. The context assessment forms basis for performing contextual adjustment.

Contextual adjustment: adjustment for the deviation in importance of management performance in a specific context in order to ensure low risk of negative impacts compared with the reference context, for which the subject-dependent assessment criteria of the multi-criteria indicator have been developed.

Context classification: a general categorisation of contexts based on probability of impacts. In the Social LCA study, all contexts of the companies comprised by the LCA are classified according to the context classification on the basis of context assessment as part of the inventory phase.

Contextual class: a category of contexts characterised by a certain probability of impacts in the context classification.

Contextual adjustment factor: applied in adjustment for the deviation in importance of management performance in a specific context in order to ensure low risk of negative impacts and compared with the reference context. Each contextual class of the context classification is represented by a contextual adjustment factor. In the characterisation step for negative impacts, the contextual risk adjustment factor (CAF) is multiplied with the company free rein (CFR) in order to obtain a company risk score (CR).

Company risk classification: a general categorisation of company risk on the basis of company risk scores. The company risk classification is applied in interpretation of company risk scores.

Company risk: expresses the risk of negative impacts taking place in a company (potential impact). It is based on assessment of a company's management performance with consideration for the context of that company. Calculation of company risk scores for all companies comprised by the Social LCA forms part of the characterisation step for negative impacts. The company risk score (CR) is obtained by multiplication of the company free rein (CFR) with the contextual adjustment factor (CAF).

Product relation factor: expresses which weight the social impact profile of a specific life cycle company shall be given in the Social LCA of a product. A product relation factor is determined for each company comprised by the Social LCA as part of product chain analysis performed in the inventory step of a Social LCA study.

Product risk score: expresses the proportion of a potential social impact of company, which can be ascribed to the product for which the LCA study is carried out. Calculation of product risk scores for all companies comprised by the Social LCA forms part of the characterisation step for negative impacts. The product risk score (PRS) is obtained by multiplication of the company risk score (CR) with the product relation factor (PRF).

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Appendix A

Table 9 Example of formation of company performance score (CP) for assessment with Abolition of Forced Labour Indicator

Abolition of forced labour inxdicator	The company has established a practice or issued a guideline, which supports integration of the measure stated in the left column			The company has communicated and delegated responsibility for compliance with the practice/ guideline to relevant managers and employees			The company performs continuous active control to ensure that managers and employees comply with the established practice or guideline			Performance score
Managerial measures **Recruitment**	I_1	I_2	I_3	II_1	II_2	II_3	III_1	III_2	I_1	$I_x \times II_x \times III_x$
1. Birth certificate, passport, identity card, work permit or other original documents belonging to the employee are not under any circumstances retained or kept for safety reasons by the company neither upon hiring nor during employment	0					2	1			0
2. No money deposit or hiring fee is received for a person to be considered for or to enter employment			4			2	1			8
3. Applied recruitment agencies do not charge hiring fees from the company's future employees or are in any other way engaged in any form of forced labour	0			1			1			0
4. Employment contracts that stipulate wage, working time, annual holidays and length of personal holiday, are issued		0.7			1.2		1			0.84
5. Employment contracts that stipulate terms of resignation, which ensure employees voluntary leave of employment after due notice, are issued		0.7			1.2		1			0.84
6. Employment contracts that are comprehensible to the employee as to terms, language and formulation are issued	0			1			1			0
7. Employment contracts are kept on file		0.7				2	1			1.4
During employment										
8. Overtime is voluntary for all employees paid by the hour			4			2	1			8
9. Overtime is always remunerated at premium rate for employees paid by the hour			4			2			2	16
10. Working hours for all employees are recorded			4			2			2	16
11. Wages are paid on time with regular intervals			4			2			2	16
12. Wages amount to at least living wage for the concerned region at all times or at least minimum wage if higher			4			2	1			8
13. Wage including bonuses and other benefits additional to ordinary wage is recorded for all managers and employees			4			2			2	16
14. Deductions in wage are only made with the consent of the employee and never for disciplinary purposes, and they are clearly stated in wage records and on employee wage slip			4			2			2	16

15. All employees and other parties have the possibility to file complaints about labour practices, which conflicts with the principles of employment on a voluntary basis, in confidentiality and without negative consequences	0		1		1		0	
16. A system for handling complaints regarding labour practices, which conflicts with the principles of employment on a voluntary basis has been established to ensure response and a fair, uniform and confidential treatment of complaints	0		1		1		0	
17. All complaints and responses are recorded	0		1		1		0	
End of employment								
18. Letter of resignation is issued and handed over to the employee upon resignation		4		2		2	16	
19.Copies of letters of resignation are kept on file		4		2	1		8	
If the company provides housing for employees								
20. Use of accommodation provided by the company is voluntary and reasonable priced compared with earned wage	N/A							
21. House rules are defined and enforced with respect for the employees' freedom of movement	N/A							
If the company is situated remote from cities								
22. Food, accommodation and other necessities provided by the company are readily available and of a certain quality	N/A							
23. Food and other necessities provided by the company are reasonable priced compared to earned wage to ensure that employees are able to maintain a decent living standard while receiving a fair wage after deductions for these services.	N/A							
If loans, credit or similar schemes indebting the employee is provided by the company								
24. Loans, credit or similar schemes indebting the employee to the employer are subject to fair and transparent management	N/A							
25. Terms of loan, credit or similar schemes indebting the employee to the company is clearly documented in each case and kept on file	N/A							
Total company performance score (CP)							131	

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